

Design Engineering - A Tool Leading to Review of Seawater Desalination Techniques

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Abstract

Design Engineering is defined as a process, leading to the development of new technologies, which refers to the outcome of innovative ideas through various brain storming activities. Source for the design thinking process originates from the various problems existing in the environment. Research survey carried out in the present paper focus on the area of work which is environmentally, socially and economically important for our nation's growth, referring to tourism. Scarcity of pure water is a growing threat to the healthy, hygienic and clean environment of the tourist places. Survey study indicates that the reason for such scarcity is due to various geographical and other conditions prevailing in that area. So, review on the problem regarding availability of fresh or pure water along the drier area of tourists' places has been reviewed through the entire process of design engineering and concluded that seawater desalination plant powered by solar energy produces freshwater and dry salt, satisfying the criteria of both, eco-friendly and economic feasibility.

Keyword- Design engineering, Desalination techniques, purified water, salt water, solar energy

I. INTRODUCTION

Design problems are open ended in nature, which means they have more than one correct solution. The result or solution to a design problem is a system that possesses specified properties. Various tools introduced in design engineering refers to the name of AEIOU framework, Empathy Canvas, Mind mapping, Ideation Canvas and Product Development Canvas. Each of the canvas has its own characteristics. Through empathy canvas, a designer has to look at the users and requires caring about their needs by listening and feeling their problems. When you move from empathy work to drawing conclusions from that work, you need to process all the things you heard and saw in order to understand the big picture and grasp the takeaways of it all in the form of mind mapping. Defining the correct problem statement is the next step followed by the ideation of the problem statement generated i.e. you have to think on the multiple solutions of the problem statement defined. Hence ideation is not about coming up with the 'right' idea; it's about generating the broadest range of possibilities through the process of iteration. Afterwards, low-resolution and cheap (in cost) prototypes of your ideation canvas should be build which a user can experience through the testing mode of your generated solutions.

Engineering is something which is related to the scientific innovations resulting from creativeness and innovative ideas of the human mind. Introduction of such design engineering course in the study will allow the students to get a platform where they are exposed to the various scientific research works. Scientific laboratories in the academic institutes will help the students to visualize the solution of various complex real world problems in the form of prototypes as suggested in the design engineering. Students will be able to think "Out of Box" which will result into their contribution towards the nation's growth directly or indirectly through the development of new products, systems or techniques. Such course will provide a great exposure to the technical skills of human mind along with the theoretical knowledge.

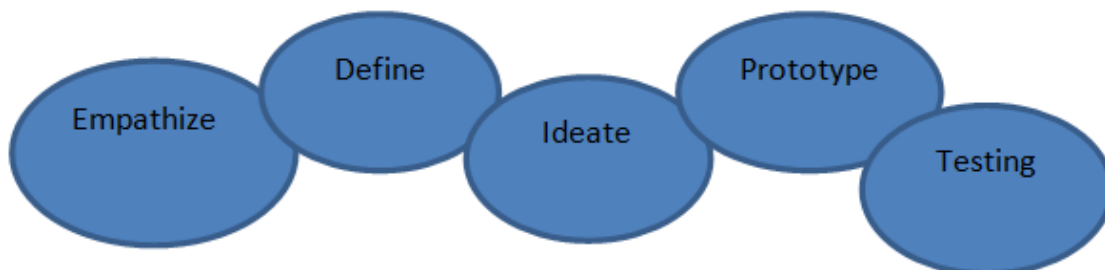


Fig. 1: Process of Design Engineering

Present paper review on the problem regarding availability of fresh or pure water along the drier area of tourists' places through the entire process of design engineering as explained above and as shown in Fig.1. Iterative process of such work will lead to the development of new solution or modification of the defined problem statement with various brain storming activities.

In the late 1940s, researchers began examining ways in which pure water could be extracted from salt water. Thermal and membrane technology are the most widely and costly methods used for the seawater desalination process. Electro dialysis and Reverse Osmosis process makes the use of membrane technology to purify salty water. Electro dialysis process purifies 75% to 95% of the source water. Work presented by Soteris A. Kalogirou (2005) suggests industrially-tested desalination systems which comprise the phase change processes, the multistage flash, multiple effect boiling and vapour compression and membrane processes, which also include reverse osmosis and electro dialysis. Another method is distillation by multiple-effect evaporators in compression distillation and such unit is known as the "Klein Schmidt still", also called a vapour compression unit whose good description is given by Dr. Richard G. Folsom. However, distillation using renewable energy source (wind power, solar energy etc.) is also in practice still long time. According to Malik et al. [9], the earliest documented work is that of an Arab alchemist in the 15th century reported by Mouchot in 1869 for the solar distillation. Experimental work on solar distillation was also performed at the National Physical Laboratory, New Delhi, India and in the Central Salt and Marine Chemical Research Institute, Bhavnagar, India [1]. Comparatively, solar distillation by direct collection system (solar stills) is a simple technology which can be operated by non-skilled workers. Also due to the low maintenance requirement, it can be used anywhere with lesser number of problems. Another method is indirect collection method which consists of two sub systems. The operating principle of these systems involves the implementation of two separate sub-systems, a renewable energy collector (solar collector, PV, wind turbine, etc.) and a plant for transforming the collected energy to fresh water. The plant sub-system is based on one of the two operating principles of membrane process or phase change process. An environmentally friendly and efficient method that desalinates seawater using thermal energy provided by solar collectors has been given by most current project named EU - DeSol (2006-2009) by Hugo Niesing.

From the design engineering prospects, ability of students to visualize the various things they see in their environment changes and it would become helpful for them to define the problem statement. So presently, empathizing the need of pure water for the tourists and also to maintain hygiene at the tourist's places, a seawater desalination plant can be ideated through the various iterative processes. Literature reviewed in the previous section states that the development of such a product governs no. of factors such as quality of the source water, the desired quantity and quality of the water produced, pre-treatment, energy and chemical requirements, site conditions, meteorological conditions etc. Therefore, the rising thought for the design of seawater distillation plant should be eco-friendly and economically feasible along with the features serving best to its quality.

II. CONCLUSION

The review of the range of broad possible solutions through iterative process for the defined problem statement for the desalination of sea water to pure water concludes that the membrane technologies are more costly and environmentally ineffective as compared to techniques utilizing renewable sources of energy.

Additionally, on using renewable energy source to convert salt water to pure water, dry salt is obtained as by product which became useful to generate revenue.

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